
World Cancer Day 2020 – Reflecting on a Decade of NIOSH Cancer Research

Posted on February 4, 2020 by Raquel Velazquez-Kronen, Ph.D.; and Jasmine Nelson,
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February 4th, 2020 is World Cancer Day

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(<http://www.cdc.gov/cancer/dcpc/resources/features/WorldCancerDay/>), and we are reflecting on the role of the occupational cancer research being done at the National Institute for Occupational Safety and Health (NIOSH) in reducing the burden of cancer worldwide. Cancer develops as a result of the body losing its ability to control the growth and spread of abnormal cells. Globally, cancer is the 2nd leading cause of death accounting for 9.6 million deaths in 2018 (IARC 2020). There are 17 million people diagnosed with cancer every year worldwide, and this number is expected to increase (ACS 2018).

While there is no single root cause of cancer, there are a wide range of exposures that may contribute to a person's risk of cancer; this includes but is not limited to:

- Modifiable behaviors, such as alcohol and tobacco use;
- Environmental exposures to ultraviolet light, pesticides, and pollution;
- Infectious agents, such as viruses;
- Inherited genetic mutations; and
- Workplace exposures.

The Role of Workplace Exposures in Cancer Burden

Some specific occupations that have been linked to increased cancer risk include rubber manufacturing, paving, roofing, painting, and chimney sweeping. It has been estimated that 2-8% of all cancers worldwide are caused by exposures to carcinogens (substances known to cause cancer) in the workplace (Purdue et al. 2015). In 2016 (the most recent year with available data), there were between 49,761 and 132,697 new cancer cases in the U.S. that were caused by past exposure in the workplace (U.S. Cancer Statistics Working Group 2019). Worldwide, there are 340,738 and 1,362,952 new cancer diagnoses each year caused by occupational exposure. It may be safely assumed that these numbers are underestimated since our knowledge of all the possible carcinogens in the workplace is emerging.

Cancers that occur due to workplace exposures can be prevented. At NIOSH, we investigate the carcinogenic risk related to physical and chemical agents by conducting studies of exposed workers. This allows us to better understand the relationship between work and cancer.

A Decade of NIOSH Cancer Epidemiology Studies

Over the last decade, investigators at NIOSH have published over 50 epidemiologic studies of workplace-related cancer. These studies have evaluated a wide range of potentially carcinogenic agents. See the NIOSH Cancer Study References, 2009-2020 below.

- Particulates, fibers, and metals (such as diesel exhaust, asbestos, cadmium metal) and lung cancer
- Chlorinated solvents and pesticides and glioma
- Ortho-toluidine and bladder cancer
- Formaldehyde, polychlorinated biphenyls (PCBs), and ionizing radiation and several cancer types, such as lung and stomach cancer
- Industry-specific exposures (such as construction and microelectronics)

manufacturing) and several cancer types, such as leukemia

- Occupation-specific exposures (such as coal miners, aircrew, and firefighters) and several cancer types, such as lung cancer

The Impact of NIOSH Occupational Cancer Research

NIOSH has had a far-reaching impact on both national and international evaluations of potentially carcinogenic agents as well as exposure limits and recommendations released by national and international agencies.

Some important findings of recently published studies include:

- Mortality from leukemia was associated with duration of employment among styrene-exposed workers, such as those in the boatbuilding industry (Ruder et al. 2016; Bertke et al., 2018). These findings provide evidence for the carcinogenicity of styrene in humans, which the International Agency for Research on Cancer (IARC) classified as a Group 2A (probably carcinogenic to humans) carcinogen (IARC 2019a).
- NIOSH investigators developed a large cohort of nearly 30,000 firefighters from Chicago, Philadelphia, and San Francisco. In this cohort, elevated rates of overall and site-specific cancers were observed, including digestive, oral, respiratory, and urinary cancers as well as leukemia (Daniels et al. 2014; Daniels et al. 2015). These previous findings were confirmed in a recent cohort update (Pinkerton et al. 2020). Findings from these studies contributed to the newly established National Firefighter Registry (NFR) (NFR 2019).
- Previous NIOSH studies of industrial chemical exposures (IARC 2018), insecticides and herbicides (IARC 2017), solvents (IARC 2016), and diesel exhaust (IARC 2013) have also been vital in recent reviews of carcinogenic agents conducted by IARC.
- In one of the largest cohorts of former flight attendants, an association was observed between higher cosmic radiation exposure, greater number of times zones crossed, and incidence of breast cancer in a sub-group of women (Pinkerton et al. 2016). The NIOSH flight attendant study is one of very few aircrew studies

with detailed individual exposure estimates for circadian rhythm disruption and cosmic radiation exposure.

- Incidence of bladder cancer was positively associated with exposure to ortho-toluidine in a cohort of rubber manufacturing workers (Carreon et al. 2010; Carreon et al. 2014). This study was included in the National Toxicology Program (NTP) 2014 [assessment of ortho-toluidine \(https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/completed/otoluidine/index.html\)](https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/completed/otoluidine/index.html) as a potential cancer-causing agent, which ultimately considered ortho-toluidine be a known human carcinogen. The results of this study were also important in IARC's review of ortho-toluidine, which IARC determined to be Group 1 carcinogen (IARC 2012).
- Risk of lung cancer was elevated in beryllium-exposed workers at several processing plants (Schubauer-Berigan et al. 2011). These findings were used in an assessment of lung cancer risk by the Occupational Health and Safety Administration (OSHA) as part of a reevaluation of the permissible exposure limit for beryllium and beryllium compounds in workplaces (OSHA 2015; OSHA 2017). A follow-up study was published which also supported these findings (Schubauer-Berigan et al. 2017).*

NIOSH investigators remain committed to improving our understanding of the complex role of work-related factors in the development of cancer. Looking to the future, NIOSH cancer research will continue to be a critical component to the prevention of cancer worldwide.

The Future of Occupational Cancer Research

In 2019, a group of 29 cancer researchers from 18 countries met to prioritize over 100 nominations of potential carcinogens that were submitted to the Monographs Program of IARC for evaluation during 2020-2024. The group's recommendations

included many potential occupational exposures, such as metalworking fluids, disinfection byproducts, nanomaterials, non-ionizing radiation, and firefighting exposures (IARC 2019b).

Additional work at NIOSH on preventing occupational cancer includes the development of the National Firefighter Registry (NFR). The NFR is a new voluntary registry of U.S. firefighters that will help monitor and better understand their occupational cancer risks. NIOSH will work with fire service organizations to announce when enrollment is open. For more information and program updates please visit:

<https://www.cdc.gov/niosh/firefighters/registry.html>

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What do you think should be at the forefront of future research on workplace cancer risks? Let us know in the comments below.

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One comment on “World Cancer Day 2020 – Reflecting on a Decade of NIOSH Cancer Research”

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Yvonne Noel says:

February 4, 2020 at 3:04 pm (<https://blogs.cdc.gov/niosh-science-blog/2020/02/04/world-cancer-day-2020/#comment-402364>)

It is my opinion that hand sanitizers/alcohol should be studied. That substance may be an irritant rather than a carcinogen, but because of the widespread use, the impact could be significant.

Reply (<https://blogs.cdc.gov/niosh-science-blog/2020/02/04/world-cancer-day-2020/?replytocom=402364#respond>)

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